forming a contact hole which penetrates an interlayer insulating film formed on a semiconductor substrate;

forming an electric conductive film on said interlayer insulating film whereby said contact hole is filled to obtain a contact to said substrate;

forming an insulating film on said electric conductive film;

patterning by an anisotropic etching said insulating film and said electric conductive film to form a configuration corresponding to said cylindrical portion so that the core and the bottom portion of said cylindrical portion are formed;

[the step of] forming the cylindrical portion on the side of [the] <u>said</u> core and [the] <u>said</u> bottom portion wherein an outer wall of [the] <u>said</u> cylindrical portion is roughened, [comprises] <u>comprising</u> forming <u>a</u> [amorphous] <u>film containing</u> silicon on said core and said bottom portion; roughening an outer surface of said [amorphous] <u>film containing</u> silicon by forming silicon grains in the outer surface of it; and conducting an anisotropic etching for patterning to form a side-wall like cylindrical portion at the side of said core and said bottom portion;

removing said core;

forming a dielectric film to cover said cylindrical storage node comprising said cylindrical portion and said bottom portion; and

forming a cell plate on said dielectric film, whereby a capacitor constituted by said cylindrical storage node, said dielectric film and said cell plate is formed.

7. (Amended) A method for producing a semiconductor device [according to Claim 5, wherein] having a cylindrical storage node comprising a bottom portion and a

cylindrical portion which surrounds an outer circumference of said bottom portion and extends upward, which comprises steps of:

forming a contact hole which penetrates an interlayer insulating film formed on a semiconductor substrate;

forming an electric conductive film on said interlayer insulating film whereby said contact hole is filled to obtain a contact to said substrate;

forming an insulating film on said electric conductive film;

a step of patterning by an anisotropic etching said insulating film and said electric conductive film to form a configuration corresponding to said cylindrical portion so that the core and the bottom portion of said cylindrical portion are formed;

[the step of] forming the cylindrical portion on the <u>side of said</u> core and [the] <u>said</u> bottom portion wherein an outer wall of [the] <u>said</u> cylindrical portion is roughened, [comprises] <u>comprising</u> forming amorphous silicon on said core and said bottom portion; conducting an anisotropic etching to form a side-wall like cylindrical portion at the side of said core and said bottom portion; and roughening an outer surface of said amorphous silicon by forming silicon grains in the outer surface of it to thereby form said cylindrical portion;

removing said core;

forming a dielectric film to cover said cylindrical storage node comprising said cylindrical portion and said bottom portion; and

forming a cell plate on said dielectric film, whereby a capacitor constituted by said cylindrical storage node, said dielectric film and said cell plate is formed,

wherein the inner wall of the cylindrical portion having a roughened outer wall is constituted by amorphous silicon.

- 8. (Amended) A method for producing a semiconductor device according to Claim 6, wherein the roughening of the outer surface of the [amorphous] <u>film</u> containing silicon is selected from the group consisting of a heat treatment with use of silane and a heat treatment in vacuum after a treatment to the outer surface of said [amorphous] <u>film containing</u> silicon with use of hydrofluoric acid, whereby projections and recesses are formed in the outer wall of said amorphous silicon by forming silicon grains in the outer wall.
- 10. (Amended) A method for producing a semiconductor device according to Claim 8, wherein the inner wall of the cylindrical portion having a roughened outer wall is constituted by <u>said film containing silicon</u>, <u>said film containing silicon including</u> amorphous silicon.
- 12. (Amended) A method for producing a semiconductor device having a cylindrical storage node comprising a bottom portion and a cylindrical portion which surrounds an outer circumference of said bottom portion and extends upward, which comprises steps of:

[a step of] forming a contact hole which penetrates an interlayer insulating film formed on a semiconductor substrate;

[a step of] forming an electric conductive film on said interlayer insulating film whereby said contact hole is filled to obtain a contact to said substrate;

[a step of] forming an insulating film on said electric conductive film;

[a step of] patterning by an anisotropic etching said insulating film and said electric conductive film to form a configuration corresponding to said cylindrical portion so that the core and the bottom portion of said cylindrical portion are formed;

[a step of] forming the cylindrical portion on the side of said core and said bottom portion wherein an outer wall of said cylindrical portion is roughened;

[a step of] forming a dielectric film on said cylindrical storage node comprising said cylindrical portion and said bottom portion within which said core remains; and

[a step of] forming a cell plate on said dielectric film, whereby a capacitor constituted by said cylindrical storage node, said dielectric film and said cell plate is formed.

13. (Amended) A method for producing a semiconductor device according to Claim 12, wherein the step of forming the cylindrical portion on the side of the core and the bottom portion wherein [an] the outer wall of the cylindrical portion is roughened, comprises forming amorphous silicon on said core and said bottom portion; roughening an outer surface of said amorphous silicon by forming silicon grains in the outer surface of it; and conducting an anisotropic etching for patterning to form a sidewall like cylindrical portion at the side of said core and said bottom portion.